

MEROPE TUBER (MECOPTERA):
A WING-BODY INTERLOCKING MECHANISM

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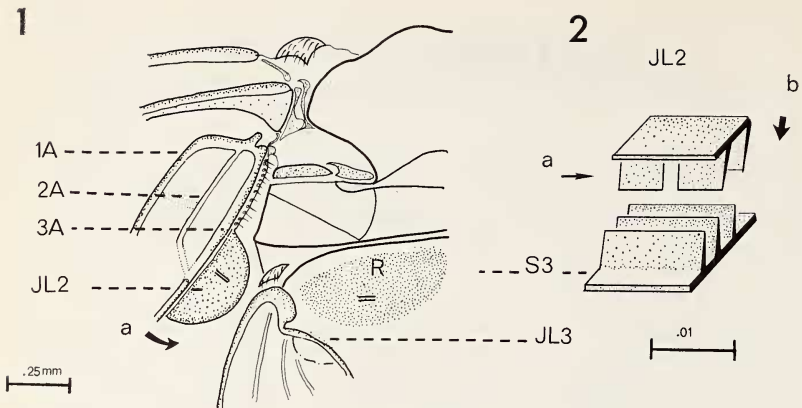
As an insect pushes its dorsal surface against obstacles while moving through a substrate, the wings will tend to be forced apart. In many Coleoptera, such divergence is prevented by a complex of devices interlocking the elytra with the thorax and abdomen. A common interlocking mechanism involves intermeshing of parallel arrays of setae angled towards the potentially disrupting force (Fig. 2). A similar high friction binding system on the mesojugum and metascutellum of *Merope tuber* provides additional evidence for the ground dwelling habits of this rare mecopteran.

The fore-jugal lobe of *Merope* is highly modified relative to its counterpart on the hind wing and as compared with the jugal regions of other panorpoidea (Fig. 1; JL2, JL3). It does not bear setae and does not appear to function in wing coupling. More importantly, the mesojugal lobe is much thicker, more heavily sclerotized than the wing proper, is quite rigid, yet capable of slight movement about the third anal vein, but does not fold over as the wing comes to rest. The ventral surface is completely covered with uniformly small ($.007 \times .003$ mm) flat topped carinae, angled posteriorly and organized in rows perpendicular to the long axis of the wing (Figs. 1, JL2; 3, 4). The metascutellum bears two patches of anteriorly projecting ridges about twice as long ($.017 \times .003$ mm) but about as high as those on the fore wing (Figs. 1, R, S3; 5).

In rest position, the jugal lobes lie close together and directly above the striate metathoracic areas. When so placed, a small ventral movement will cause the slanting nearly parallel ridges to intermesh. Two functions, which may be combined, may be served by the juxtaposition of parallel carinae: stridulation and interlocking. Stridulation is an unlikely function for these structures. As the wing moves medially to rest, the ridges move parallel to one another, not

¹Research supported by NSF grant GB 31173, F. M. Carpenter, Harvard University, Principal Investigator. Manuscript completed at Cornell where E. H. Smith kindly made necessary facilities available.

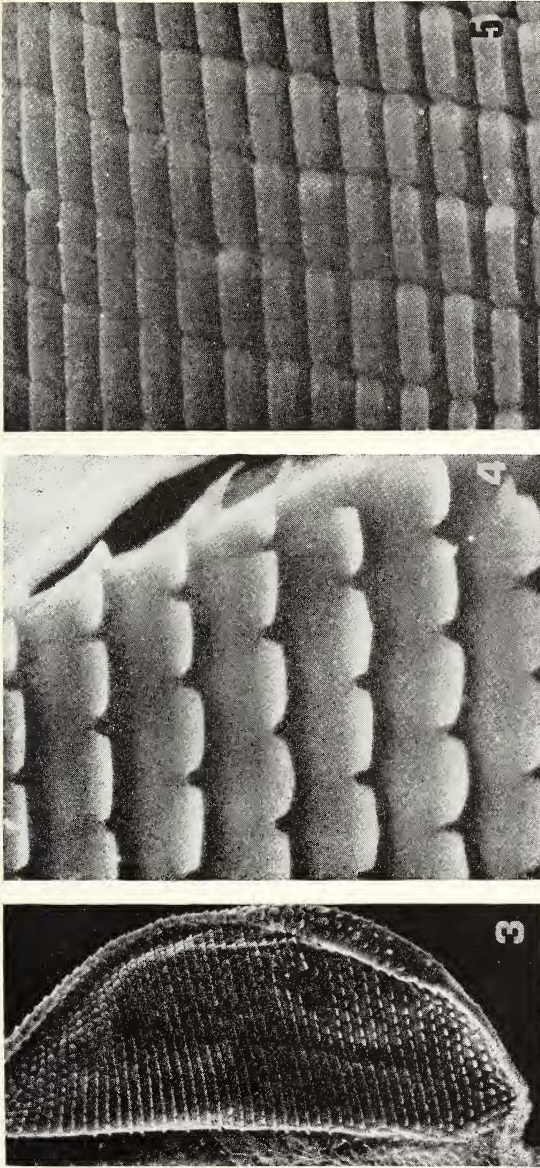
Manuscript received by the editor June 15, 1974.



Figs. 1-2. Wing-body interlocking mechanism of *Merope*. Fig. 1. Left half of pterothorax, dorsal view. As the fore-wing moves medially (a); parallel ridges, indicated by two heavy lines, on the jugal lobe (JL2), and on the metascutellum (R, S3) are brought into contact. Fig. 2. Model of interlocking system, posterior view. Small arrow (a) indicates direction of emplacement as wing comes to rest, see Fig. 1; large arrow (b) the direction of intermeshing of the slanted ridges. 1A, 2A, 3A, anal veins; JL2, JL3, meso- and metajugal lobes; R, ridge bearing patch of metascutellum, S3; a, direction of wing movement; b, direction of interdigitation.

perpendicularly as in many sound producing structures (Fig. 2, a). Stridulatory mechanisms are not known in Mecoptera (Riek 1967). The geometry of ridge interdigitation, however, is precisely that required to resist postero-lateral wing displacement during locomotion within a substrate or interstitial spaces. The unique jugal lobe and metascutellar structures of *Merope* may serve then as a wing-body interlocking mechanism which increases structural integrity during crawling within a matrix.

Other structural features and meagre biological data suggest that *Merope* is a substrate inhabitant not a surface dweller as are other winged Mecoptera. The body is dorso-ventrally flattened; the pleural axes of the undifferentiated thoracic segments are sharply inclined from the vertical (Mickoleit 1967). The fore wing is somewhat tegmenized, being thicker and more heavily sclerotized than the hind wing. Antennae and legs are short; pterothoracic appendages may operate almost entirely within the outlines of the flattened wings. Little membrane is exposed between tagmata and between abdominal segments. These characters result in greatly reduced cross section area



Figs. 3-5. Wing-body interlocking mechanism of *Merope*. Scanning electron micrographs. Fig. 3. Mesojugal lobe, ventral view, magnification ca. $40\times$. Fig. 4. Detail of jugal lobe, ca. $1.3K$. Fig. 5. Detail of ridge bearing zone of metascutellum, ca. $.65K$.

during locomotion and improved structural integrity relative to other panorpoids. Some specimens have been taken under logs or stones, as were the only known examples of *Austromerope*. The photographs in the original description (Killington 1933) show that the jugal lobe of this Australian form is similar to that of *Merope* in size and shape. Several lines of evidence point towards a marked divergence of meropeids from surface dwelling, loosely constructed configurations of related taxa.

The transformations required to derive *Merope* from a generalized mecopteran are parallel and analogous to those hypothesized for the very early evolution of substrate dwelling Coleoptera (Hlavac 1972). The ability to keep flexible wings in place under stress through interlocking devices is an obvious precursor for the development of elytra. Meropeids may then represent an attempt, albeit a feeble one, by another holometabolous lineage to occupy the substrate adaptive zone.

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